

# APPLICATION UNDER UNITED STATES PATENT LAWS

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Invention: ELECTRONIC APPARATUS HAVING PUSH BUTTONS ON THE HOUSING

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This is a:

- ☐ Provisional Application
- ☒ Regular Utility Application
- ☐ Continuing Application
  - ☐ The contents of the parent are incorporated by reference
- ☐ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application
- ☐ Substitute Specification
  - Sub. Spec Filed \_\_\_\_\_
  - in App. No. \_\_\_\_\_ / \_\_\_\_\_
- ☐ Marked up Specification re
  - Sub. Spec. filed \_\_\_\_\_
  - In App. No \_\_\_\_\_ / \_\_\_\_\_

## SPECIFICATION

# TITLE OF THE INVENTION

ELECTRONIC APPARATUS HAVING PUSH BUTTONS ON THE HOUSING

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the  
5 benefit of priority from the prior Japanese Patent  
Application No. 2003-047727, filed February 25, 2003,  
the entire contents of which are incorporated herein by  
reference.

## BACKGROUND OF THE INVENTION

### 10 1. Field of the Invention

The present invention relates to an electronic  
apparatus that have push buttons such as a click switch  
button and a power switch button. More particularly,  
the invention relates to a structure that supports push  
15 buttons on the housing of an electronic apparatus.

### 2. Description of the Related Art

Most portable computers have push buttons such as  
a power switch button and a click switch button.  
The push buttons are exposed on the housing of  
20 the portable computer. The user of the portable  
computer can therefore operate the push buttons with  
the fingers.

Jpn. UM Appln. KOKAI Publication No. 5-87764, Jpn.  
Pat. Appln. KOKAI publication No. 2001-236852 and U.S.  
25 Patent No. 6,160,232 disclose push buttons that are  
used on an electronic apparatus such as a portable  
computer. Each of these push buttons comprises

a button body and a plurality of arms. The button body and the arms are made of synthetic resin and formed integral with one another. The button body protrudes outwards through an opening made in an outer wall of the housing of the electronic apparatus. It is therefore exposed outside the housing and can be pushed with a finger. The arms are elastic and project from the periphery of the button body. The arms have their distal ends secured to the inner surface of the outer wall. Thus, the arms support the button body to the housing. Thanks to the elasticity of the arms, the button body can be displaced with respect to the housing.

In the case of the conventional push button, the arms that support the button body to the housing of the electronic apparatus project from the periphery of the button body for a long distance. The push button is inevitably large as a whole.

Particularly, the push button disclosed in Jpn. Pat. Appln. KOKAI publication No. 2001-236852 is large because it has a frame that surrounds the button body. The arms are provided between the frame and the button body and connect the button body to the frame. Consequently, the push button cannot be as compact as is desired for a component to be incorporated into the housing of an electronic apparatus.

### BRIEF SUMMARY OF THE INVENTION

According to an embodiment of the present invention, there is provided an electronic apparatus comprises a housing having an outer wall and a push  
5 button secured to the outer wall by an arm and overlapping the arm. The arm can be deformed to being elastically deformable to move.

### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated  
10 in and constitute a part of the specification, illustrate presently preferred embodiments of the invention, and together with the general description given above and the detailed description of the preferred embodiments given below, serve to explain the  
15 principles of the invention.

FIG. 1 is a perspective view of a portable computer according to a first embodiment of this invention;

FIG. 2 is an exploded view illustrating the  
20 positional relation between a frame and a printed circuit board, the frame having a click switch button and the board having a click switch and a touch pad;

FIG. 3 is a perspective view of the frame used in the first embodiment of the invention;

25 FIG. 4 is an exploded view of a push button used in the first embodiment, representing the positional relation between the base and button top of the push

button;

FIG. 5 is a rear view of the frame used in the first embodiment of the invention;

FIG. 6 is a magnified view of part F6 of FIG. 5;

5        FIG. 7 is a rear view of the frame used in the first embodiment, showing first and second click switch buttons attached to the frame;

10        FIG. 8 is a sectional view of a housing of a second embodiment of the invention, the housing having a push button; and

FIG. 9 is a partly sectional plan view showing the housing of the second embodiment, representing the positional relation between the recess, arms, base and button top.

15                    DETAILED DESCRIPTION OF THE INVENTION

The first embodiment of the present invention will be described with reference to the accompanying drawings.

20        FIG. 1 depicts a portable computer 1, which is an electronic apparatus according to this invention. The portable computer 1 comprises a main unit 2 and a display unit 3.

25        The main unit 2 has a housing 4 shaped like a flat box. The housing 4 has a top wall 4a that is an outer wall. The top wall 4a supports a keyboard 5. The keyboard 5 has a plurality of key tops 6 and a joystick 7. The joystick 7, which is a pointing

device, is positioned at the center of the keyboard 5.

5       The front half of the top wall 4a serves as a palm  
rest 8, on which the user of the computer 1 may rest  
his or her hands. The palm rest 8 is located in front  
of the keyboard 5. It extends in the widthwise  
direction of the housing 4. Two speaker units 9a and  
9b are secured to the edge of the top wall 4a. They  
are spaced apart in the widthwise direction of the  
housing 4 and project upwards from the rear edge of the  
10 top wall 4a.

      The display unit 3 comprises a display housing 11  
and a liquid crystal display panel 12. The display  
housing 11 is shaped like a flat box and has  
a rectangular opening 13 in its front. The liquid  
15 crystal panel 12 has a screen 12a designed to display  
images. The screen 12a is exposed outside the display  
housing 11 through the opening 13.

      As FIG. 1 shows, the display housing 11 has a leg  
14 at the lower side. The leg 14 lies between the  
20 speaker units 9a and 9b. The leg 14 is coupled to the  
rear edge of the housing 4 by a hinge (not shown).  
The hinge has an axis X1 that extends in the widthwise  
direction of the housing 4.

      The display unit 3 can rotate around the axis X1  
25 of the hinge, from a closed position and an opened  
position. At the closed position, the display unit 3  
lies on the main unit 2, covering the keyboard 5 and

palm rest 8 from above. At the opened position, the display unit 3 stands up, exposing the keyboard 5 and palm rest 8. The screen 12a remains exposed as long as the display unit 3 stays at the opened position.

5           The palm rest 8 has a rectangular hole 16 at a part that is middle with respect to its widthwise direction. A push-button unit 17 is fitted in the hole 16. As FIG. 2 shows, the push-button unit 17 comprises a frame 18, a printed circuit board 19,  
10           a first pair of click-switch buttons 20a and 20b, and a second pair of click-switch buttons 21a and 21b.

          The frame 18 is fitted in the hole 16 made in the palm rest 8. As FIG. 3 illustrates, the frame 18 has a flat upper surface 22 and first to fourth through  
15           holes 23a to 23d that open at the upper surface 22. The upper surface 22 of the frame 18 lies in flush with the upper surface of the palm rest 8. The first through hole 23a is a long rectangular one, extending in the widthwise direction of the housing 4. It is  
20           made in the rear part of the frame 18, which is adjacent to the keyboard 5. The second through hole 23b is rectangular and made in the center part of the frame 18. A rim 24 is fitted in the second through hole 23b, contacting the edges of the hole 23b.  
25           The fifth through hole 23e is made in the rear part of the rim 24. It is a long rectangular one, extending in the widthwise direction of the housing 4 and lies in

front of the first through hole 23a. The third and fourth through holes 23c and 23d are elongated in the widthwise direction of the housing 4. They are spaced apart in the widthwise direction of the housing 4.

5           The printed circuit board 19 is fastened to the lower surface of the frame 18 by means of screws 26. On the upper surface of the printed circuit board 19, a touch pad 27 and a pair of click switches 28a and 28b are mounted. The touch pad 27 is a type of a pointing  
10           device. It has an input surface 29, which is flat and which the user of the computer 1 may touch with a finger. The input surface 29 is exposed outside the housing 4, through the second through hole 23b. The click switches 28a and 28b are provided in front of  
15           the touch pad 27 and spaced apart in the widthwise direction of the housing 4. They are located right below the third and fourth through holes 23c and 23d, respectively. When depressed, the click switch 28a executes any command input by operating the touch  
20           pad 27. When depressed, the click switch 28b cancels any command input by operating the touch pad 27.

          A flexible printed wiring board 31 is electrically connected to the rear edge of the printed circuit board 19. The printed wiring board 31 has two click  
25           switches 32a and 32b. When depressed, the click switch 32a executes any command input by operating the joystick 7. When depressed, the click switch 32b



cancels any command input by operating the joystick 7.  
The click switches 32a and 32b are provided in rear of  
the touch pad 27 and spaced apart in the depth  
direction of the housing 4. They are located right  
5 below the first and fifth through holes 23a and 23e,  
respectively.

As FIG. 2 shows, the click-switch buttons 20a and  
20b of the first pair are elongated ones; they are  
shaped like the first through hole 23a and the fifth  
10 through hole 23e. The click-switch buttons 20a and 20b  
are fitted in the first through hole 23a and fifth  
through hole 23e from below, respectively. They have  
their upper surfaces exposed at the upper surface 22 of  
the frame 18 and can therefore be pushed with  
15 fingertips.

As shown in FIG. 7, the click-switch buttons 20a  
and 20b of the first pair are connected to each other  
by a pair of arms 33a and 33b. The click-switch  
buttons 20a and 20b and the arms 33a and 33b are made  
20 of synthetic resin and formed integral. The arms 33a  
and 33b are elastic. The arms 33a and 33b extend  
between the click-switch buttons 20a and 20b, each  
curved around one end of the click-switch button 20a.  
The arms 33a and 33b have their middle parts fastened  
25 to the frame 18 with two screws 34, respectively.

Thus, the click-switch buttons 20a and 20b of the  
first pair are supported on the frame 18 by the arms

33a and 33b. Since the arms 33a and 33 are elastic,  
the click-switch buttons 20a and 20b can be moved  
between a standby position and a depressed position.  
At the standby position, the click-switch buttons 20a  
5 and 20b protrude a little from the upper surface 22 of  
the frame 18. At the depressed position, the click-  
switch buttons 20a and 20b lie a little below the  
standby position.

The click-switch buttons 20a and 20a of the first  
10 pair have a projection 35 each. The distal ends of the  
projections 35 of the click-switch buttons 20a and 20b  
face the click switches 32a and 32b, respectively.  
When the user pushes the click-switch button 20a or 20b  
with a fingertip, from the standby position to the  
15 depressed position, the projection 35 contacts the  
click switch 32a or 32b. That is, the click switch 32a  
or 32b is turned on.

The click-switch buttons 21a and 21b of the second  
pair are push buttons according to the present  
20 invention. The click-switch buttons 21a and 21b  
comprise a base 36 and a button top 37 each. The bases  
36 of the click-switch buttons 21a and 21b are provided  
in the third and fourth through holes 23c and 23d,  
respectively.

25 To be more specific, the bases 36 are plates that  
are smaller than the third and fourth through holes 23c  
and 23d. They are surrounded by the rims of the holes

23c and 23d, respectively. Each base 36 have a first  
end part 36a and a second end part 36b, which are  
spaced apart in the lengthwise direction of the through  
hole 23c or 23d. The end parts 36a and 36b of one base  
5 36 are connected to the rim of the third through holes  
23c by two arms 38a and 38b. The end parts 36a and 36b  
of the other base 36 are connected to the rim of the  
fourth through hole 23d of the frame 18 by two arms 38a  
and 38b. The frame 18, bases 36 and arms 38a and 38b  
10 are made of synthetic resin and formed integral with  
one another. The arms 38a and 38b are elastic.

The arms 38a and 38b project from the frame 18  
inwards in the third and fourth through holes 23c and  
23d, respectively. In other words, the arms 38a and  
15 38b are symmetrically held between the rim of the third  
and fourth through hole 23c and 23d and the base 36 of  
the click-switch buttons 21a and 21b.

The button tops 37 of the click-switch buttons 21a  
and 21b are made of synthetic resin. They are shaped  
20 like a flat plate and larger than the bases 36. Each  
button top 37 is secured to the base 36 by means of  
heat bonding or adhesion and covers the base 36 from  
above. Thus, the click-switch buttons 21a and 21b of  
the second pair are supported on the frame 18 by the  
25 arms 38a and 38b. They can be moved between a standby  
position and a depressed position, thanks to the  
elasticity of the arms 38a and 28b.

At the standby position, the click-switch buttons 21a and 21b have their upper surfaces set in flush with the upper surface 22 of the frame 18. At the depressed position, the click-switch buttons 21a and 21b lie  
5 below the standby position. Since the arms 38a and 38b are symmetrically arranged, either click-switch button of the second pair can be moved down without inclining to the frame 18.

As FIG. 4 illustrates, the peripheral part 39 of  
10 either button top 37 protrudes from the periphery of the base 36. It covers the third and fourth through holes 23c and 23d and the arms 38a and 38b, from above the frame 18. That is, the button top 37 of either click-switch button of the second pair  
15 overlaps the arms 38a and 38b. Hence, the arms 38a and 38b lie below the peripheral part 39 of the button top 37.

As shown in FIGS. 5 to 7, the bases 36 of the click-switch buttons 21a and 21b of the second pair  
20 have a projection 40 each. The projection 40 is provided on the center part of the lower surface of either click-switch button (21a, 21b). The distal ends of the projections 40 opposes the click switches 28a and 28b, respectively. When the user pushes the click-  
25 switch button 21a or 21b with fingertip, from the standby position to the depressed position, the projection 40 of the click-switch button contacts

the click switch associated with the click-switch button pushed. As a result, the click switch 28a or 28b is turned on.

5 In this configuration, the arms 38a and 38b that support the click-switch buttons 21a and 21b of the second pair remain overlapping the peripheral parts 39 of the button tops 37, respectively. Thus, the peripheral parts 39 of the button tops 37 covers the arms 38a and 38b, respectively, from above the  
10 frame 18.

Neither the arm 38a nor the arm 38b protrude from the button tops 37. The arms 38a and 38b can be placed in the third and fourth through holes 23c and 23d of the frame 18. This helps to reduce the space for the  
15 click-switch buttons 21a and 21b of the second pair and ultimately to make the frame 18 small. Therefore, the push-button unit 17 is so compact that it can be provided on the palm rest 8, i.e., the front half of the top wall 4a of the housing 4.

20 An electronic apparatus according to the second embodiment of the invention will be described, with reference to FIGS. 8 and 9.

As FIGS. 8 and 9 show, the housing 51 of the electronic apparatus has an outer wall 52. The outer  
25 wall 52 has a rectangular recess 53. The recess 53, which opens outside the housing 51, provides a button region. The recess 53 is defined by a bottom wall 54

and four side walls 55a to 55d. The bottom wall 54 has an opening 56, which exposes the interior of the housing 51.

5       The housing 51 contains a printed circuit board 58. The printed circuit board 58 has a push-type switch 59. The switch 59 opposes the opening 56.

10       A push button 60 is arranged in the recess 53 made in the outer wall 53. When the push button 60 is depressed, it actuates the push-type switch 59. The push button 60 comprises a base 61 and a button top 62. The base 61 lies within the recess 53 and is surrounded by the side walls 55a to 55d. The base 61 has a first end part 61a and a second end part 61b, which are spaced apart in the lengthwise direction of the recess 53. Arms 63a and 63b secure the end parts 61a and 61b to the side walls 55a and 55c, respectively. The outer wall 52, base 61 and the arms 63a and 63b are made of synthetic resin and formed integral with one another. The arms 63a and 63 are elastic.

20       The arms 63a and 63b are provided in the space defined by the side walls 55a and 55c, on the one hand, and the base 61, on the other hand. The arms 63a and 63b are bent in the form of letter S and exhibit sufficient elasticity. They are symmetrical with respect to the base 61.

25       The button top 62 is made of synthetic resin. It is shaped like a flat plate and larger than the

base 61. It is secured to the base 61 by means of heat-bonding or adhesion and covers the base 61 from above. The push button 60 is therefore held in the recess 53 and supported by the arms 63a and 63b.

5 Thanks to the elasticity of the arms 63a and 63b, the push button 60 can be moved between a standby position and a depressed position.

At the standby position, the push button 60 outwardly projects a little from the outer wall 52.

10 At the depressed position, the push button 60 lies deeper in the recess 53 than at the standby position. While depressed, the push button 60 does not incline to the bottom wall 54, because the arms 63a and 63b lie symmetrical to each other with respect to the base 61.

15 The peripheral part 64 of the bottom top 62 protrudes from the periphery of the base 61. It covers the bottom wall 54, opening 56 and arms 63a and 63b. In other words, the button top 62 of the push button 60 overlaps the arms 63a and 63b. Hence, the arms 63a and  
20 63b are located between the bottom wall 54 and the peripheral part 64 of the bottom top 62.

As FIG. 8 depicts, the base 61 of the push button 60 has a projection 65. The projection 65 is provided on the center part of the lower surface of the base 61.

25 The distal ends of the projections 65 opposes the push-type switch 59 through the opening 56. When the user pushes the push button 60 with fingertip, from

the standby position to the depressed position, the distal end of the projection 65 contacts the switch 59. The switch 59 is thereby turned on.

5 In the second embodiment, the arms 63a and 63b that support the push button 60 remain overlapping the outer peripheral part 64 of the button top 62. It stays in the space defined by the peripheral part 64 and the bottom wall 54.

10 Hence, neither the arm 63a nor the arm 63b protrude from the button top 62. The arms 63a and 63b can be placed in the recess 53. This helps to reduce the space for the push button 60.

15 The present invention is not limited to the embodiments described above. For example, two arms need not be provided to support one push button. Only one arm may support one end of each push button.

20 Moreover, the electronic apparatus according to the present invention is not limited to a portable computer. This invention can be applied to any other type of an information apparatus, such as a PDA (Personal Digital Assistant).

25 Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from



the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.